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AMERICAN JOURNAL OF OPTOMETRY

VOL. 8 NO. 1

THE ANOMALIES OF THE PHORIA*

N. Levin, Opt. D.
Chelsea, Mass.

Many books and papers are written on the muscular imbalance, or innervational imbalance, or, as it is sometimes called, phoria anomalies. Some of these works are masterpieces by great masterminds. Yet, there is great confusion on this subject. The majority of our present-day writers in optometry are "herd thinkers," and the few who possess the initiative have nothing to offer in their writings on this subject. One learned writer has ventured to say that the phoria does not mean a thing. I believe it would be more befitting to admit that we do not understand them. To say the phoria are meaningless implies that it is useless to try to understand them. But a discontentment encourages the search for truth. The whole phenomena about the phoria are exceedingly complex, nevertheless, the writer will hazard and make an attempt to clarify this subject, with the hope that this will lead the readers for deeper study of the same.

Three Theories on the Relationship

In a scholarly treatise on the relationship between the convergence and the accommodation (American Journal of Optometry, Sept., 1930), Dr. Pollack has presented eighteen data to disprove, what he calls, the reflex theory of convergence. There is no divergency of opinions with regard to the bulk of the work in the convergence, the reaction being a reflex. The whole discussion is on the nature and form of relationship between the convergence and the accommodation. There are three possible forms of relationship: the parallel, the autonomous, and the common arc. The parallel theory is the view which has been, generally, held in the past. It means that the reaction of the two functions are on two separate arcs in parallelism, but join together reflexly to insure simultaneous reaction. The association of the two functions is, thus, classed as a function. The automonous theory is the one which is favored by Pollack. It means that the two functions are on two separate arcs

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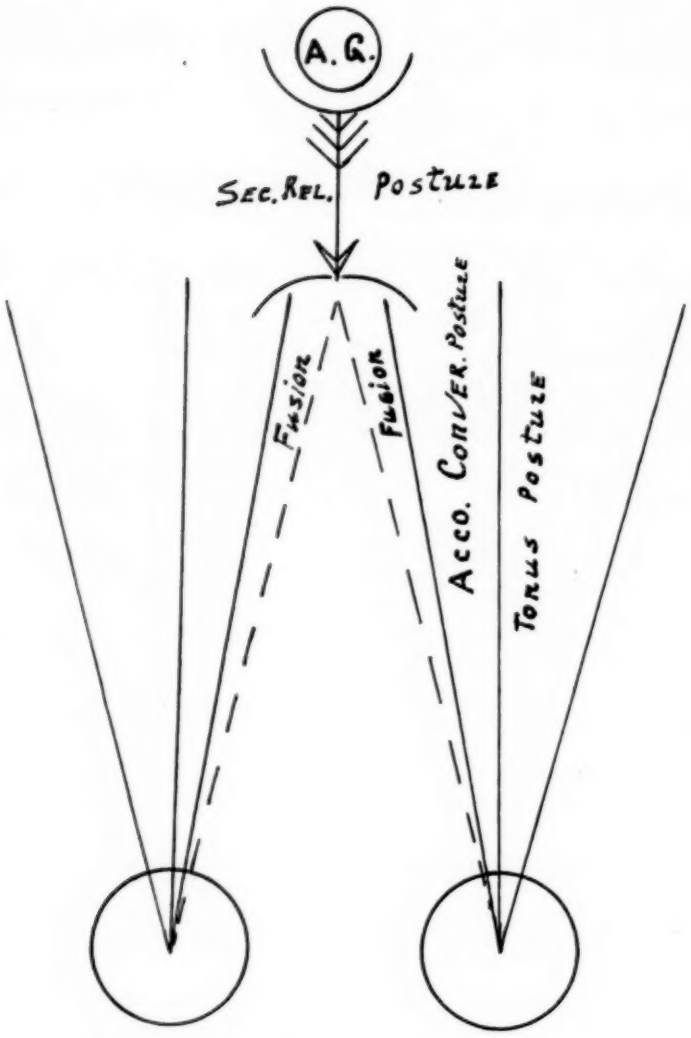

N.Levin. Figure One.

THE POSTURES OF THE CONVERGENCE

Figure 1 is a reproduction from Maddox (American Journal of Physiological Optics, 1922, page 33). It illustrates graphically the different postures of the convergence in the ideal eye. The tonus posture has been added by the writer after Bestor (Archives of Optometry, page 134, 1922).

independent of each other, and are associated by habit, rather, as an anomaly instead of a function. Unfortunately for this theory, nature does not build automonous functions. In the evolution, the organ has constantly been, and still is, *expanding by adding and assimilating*

new functions, but never in the making of independent functions. The common arc theory has been explained and illustrated graphically, by the writer, in the Optical Journal, February 28, 1930. Others may have advanced the same, but the writer is not aware of this. It means that the reaction of the two functions have but one arc in common, and their connection is not in parallelism but in series. The explanations of the phoria anomalies presented in this paper are in harmony with the writer's theory of the common arc.

The terms of these postures are given with respect to their source of energy. The tonus posture is actuated by the making and breaking of contact in the nerve endings (Le Conte). In sleep they break contact and the eyes diverge, when awake they make contact and the eyes assume their parallelism. This prepares the muscle in the proper tension to be in readiness to jump into action the moment the stimuli are applied. Strictly speaking, the tonus posture varies slightly with age: Hyper-tension in youth and hypo-tension in age. In the adult the punctum remotum of the convergence and accommodation is negative (David Klezky). The accommodative convergence is actuated, as the name implies, by the reflex of the accommodation. That is, the excitation in the center of the accommodation sets up an excitation in the center of the convergence reflexly. This should be designated as the primary reflex arc. The secondary reflex posture is generated from higher up—the angular gyrus. This is the most advanced cortical center for the "attention" of vision (Gordon Holmes). By summation and the constant repetition and exercise of the function, the volitional stimuli falls into automatism, and it is called secondary reflex. Their function is to bind the binocular and fuse the two images into one. The order of excitations, in the upward direction from the sub-cortex to the center of accommodation to the center of convergence, in the downward direction from the cortex to the center of convergence to the center of accommodation. For the motor reaction of the convergence and the accommodation to accomplish a given amount of work the amount of the energy must be balanced nicely with a multitude of varying factors. Such as slight variations in the index of the lens, its distance from the retina, its size and plasticity to curve changes. Variations in the P. D., position of attachment of the muscles, inertia, gravity, friction. All these factors are inherent in each and every pair of eyes, and no two pairs are alike. Notwithstanding all these, in all eyes, the reaction of the two functions must be simultaneous. This is made possible by connecting the two functions in series by a common arc. It means a common point for the punctum remotum of the two and a common point for the punctum proximum of the two, as the maximum and minimum of activity are the expressions of but one arc.

The Principles of Reciprocation

The motor reaction in the positive direction are in conjugate with

the motor reaction in the negative direction, or their antagonists, and they reciprocate with each other (Sherington). A sort of a "give and take" system, by the interchange of energy. This insures economy and dispatch with no waste or loss of motion. In the convergence positive, we have the sphyncter of the ciliary with the internal recti, assisted by the superior and inferior recti. This group reciprocates with the antagonists which comprehend the meridional of the ciliary with the external recti, assisted by the superior and inferior obliques. The performance of convergence, or the moving of the eyes from distance to near and from near to distance, may be visualized in the whole, in a constant state of excitation finding its equilibrium here and there with the automatic transfer of the energy, with some fluctuation in the constancy of the excitations as the mechanical resistances favor one direction more than another. This thought is in line with the dynamic theory of innervation, which is in great favor with many and characterized by Professor Baldwin as the philosophical view.

The Ametropic Phoria

We have thus pictured the state of an ideal eye. Now we will turn our attention to the ametropic eye. With the ametropization processes a gradual change takes place in the punctum remotum of the accommodation: The myope's far point is moved to some finite distance and the hyperope's far point is behind infinity. And, as stated before, the accommodation and convergence have but one point in common, the myope's far point at a finite distance must show the convergence to be esophoric, and the hyperope's far point behind infinity must show the convergence to be exophoria. Now, if the primary reflex arc would have been the only force present, the nature and degree of the ametropia would correspondingly express the nature and degree of the phoria: A myope of one diopter would show six prism diopters of esophoria, and in a myope of ten diopters the esophoria would be sixty prism diopters. Likewise, a hyperope of five diopters would show thirty prism diopters of exophoria. But there is another force present—the secondary reflex arc, which is constantly playing on the primary to maintain the binocular and compensate for the existing ametropia. Its influence is directly opposite to the effects of the ametropia. In hyperopia it exalts the positive group of the convergence arc and inhibits the negative group. In myopia the order is reversed; it exalts the negative and inhibits the positive. The ametropia thus develops into a struggle for existence of the binocular. On one hand the anatomic structures as the basic factors with their stabilized automatic nervous system tend to break up the binocular and on the other hand the volitional are forcing the reflex arc to compensate and maintain the binocular. It is the same old struggle which ensued for ages; the phylogenetic or the "type" holding down to its stabilized system, passively resisting any and all changes while the ontogenetics are forcing the compensatory processes on the organ to change to fit the environments. Each and

every phoria, be it eso or exo, are a compromise or the expressed equilibrium of the two opposing forces. When the compensatory are dominant there is exophoria with myopia and esophoria with hyperopia. When the "type" is dominant there is esophoria with myopia and exophoria with hyperopia.

The Relative Values of the Phoria

Ametropia expresses deviations from the standard eye, phoria expresses relative values between the positive and negative conjugates of the reflex arc, according to the nature of the ametropia. This will be understood best by putting the problem in quantitative form. For our hypothetical conditions we will take the ametropia to be three diopters with an esophoria of six diopters. In hyperopia, with the sphyncter of the ciliary on a par with the normal, would express an exophoria of 18 prism diopters. The presence of six diopters of esophoria shows a total of compensatory hypertrophy of 24 diopters. In myopia, the ametropic tendencies on par with the normal, would show an esophoria of 18 prism diopters, which is reduced by the compensatory hypotonia to six prism diopters. In both of these conditions the positive conjugate shows an excess of six prism diopters over the negative, while in the hyperopia the whole is intensified by 24 diopters above the normal, and in myopia the whole is reduced by 12 diopters below the normal. The same conditions with exophoria the order would be reversed; in hyperopia the excess above the normal is 12 diopters, and in myopia the reduction below the normal is 24 diopters.

All Trainings Against the Compensatory Processes

We understand why, from year to year, we find some changes in the corrections. Some compensatory processes are constantly present regardless of the nature of the phoria. It means that some latency of the ametropia is covered by the compensatory processes; in hyperopia by hypertrophia and in myopia by hypotonia, and with the correction it takes some time before the change becomes manifest. It should be noted that to reduce the correction, of a hyperope or a myope, by exercises and training will save a piece of glass. But the calling of our profession is for the *conservation of the human eye,* and not for the "conservation of glass." We must reduce the waste and build and strengthen the eye. The usual practice of training an exophoric-hyperope with prism base-out in order to reduce the plus correction and in an esophoric-myope with prism base-in in order to reduce the minus correction is, I believe, unsound. Such trainings merely constitute the developing of more and more of the compensatory processes, which are detrimental for the organ. Theoretically, all trainings should be directed against the compensatory, and a full correction of plus for the hyperope and minus for the myope regardless of the nature of the phoria. But there are cases where a slight under-correction with some prism may seem proper. The reason for it is this: A full correction for the esophoric-myope brings the far

point of the convergence and accommodation at infinity, while the phoria are at some finite distance. This creates a sort of an overflow of energy at the range of convergence, which may extend to adjacent regions with the usual complaint, "These glasses draw water from my eyes." A slight under-correction with some prism base-in compromises the P. R. to some finite distance. The method may be called a necessary evil—to make the correction tolerable to the wearer. But to make a virtue out of an evil by calling prism base-in the binocular wedge to increase the circulation in myopia, or by calling it spasm myopia to justify the training of the compensatory, are baseless. The reader is familiar with the illustrations given in the text book (Fuchs, page 635) which shows the comparison in the development in the ciliary body between the emmetrope, myope and hyperope. In hyperopia the circular or Muller's fibres are hypertrophied, while in the myopic eye they are less developed or entirely wanting. The writer will venture to say that these characteristics are present regardless of the nature of the phoria. They are the expressions of the law of compensation. One of our writers, in his attempt to belittle this law, claimed that this originated with Emerson, because he (Emerson) has written a beautiful essay on compensation. This is not true. The changes in the organs of the body, which take place in evolution, have been interpreted by different scientists in different ways. Thus: Aristotle called it the law of economy of growth, whereby an organ or structure is lost for the benefit of the organism as a whole; Lucretius showed how the strongest survive and the weak are laid low; Lemarck called it use and disuse of structures; while Darwin, harmonized these different views, called natural selection; Roux called it the physiologic struggle for existence between the organs, and Osborn termed it the law of compensation.

To summarize some of the points which are brought to light by the new system presented here: (1) In all ametropia there are either some hypertrophia or some hypotonia, depending on the nature and degree of the ametropia and the nature and degree of the phoria. The ideal eye to be taken as a standard: Hypertrophia in hyperopia and hypotonia in myopia. (2) All ametropic phoria express the relative values between the positive and negative conjugates. (3) The convergence and the accommodation are never at variance with respect to the range of excitation, even in ametropia. But being of two distinct types of muscles, nerves and centers, in ametropia, they express their individual characteristics as to the amount of the hypertrophia or hypotonia in each of these functions. In a general sense, that is, in the collective expression of a large number of cases, the lag of accommodation will bear a direct relation to the lag of convergence as shown by Dr. Tait. But in the absolute sense each muscle expresses its own characteristics. (4) The principal seat of the disturbance in the nervous system is in the struggle between the primary and secondary arcs. As Dr. Hoare says, "Phoria are nerve

liabilities of the automatic nervous system." Every increase in the degree of the phoria means an increase in the secondary arc. The muscular work accomplished is the same as in the ideal eye, but the expenditure of the energy is much greater. The katabolism in the voluntary energy are a half a million times greater than that of the reflexes (Sherington).

Some of the reasons which were offered as evidence to prove that the accommodation and the convergence are mutually independent, with no reflex connection between them, are as follows: Investigations have shown that there are two distinct centers for the accommodation and convergence. In the embryo the accommodation center develops first. After birth the accommodation and convergence do not begin to operate synchronously. The former appears before the latter.

In the works of the great authors we often find a statement which reads something like this: "This center is in a more advanced position than that center." A very simple statement with a very broad significance. The relative position of a center denote its rank in the order or scale of the functions. The more the position of a center is in the rear, the simpler its function, the more stabilized and reflex its nature, the more remote its origin, or the longer its existence with man. The more the position of the center is advanced, the less reflex its nature, the more complex its function, the less remote its origin. In the relative position of the centers or in the priority of the development of one function over another, we may read some chapters in the history of the creation of man.

By the law of differentiation each function has its specific center, fibres and pathways. What constitutes an organ is the expressed relationship of all its parts: The parts are so arranged and connected with each other to express but one thing—the life and well-being of the whole. It is not for the anatomist or microscopist to determine whether there is one center for the accommodation and convergence or two centers. Or do they all spring into existence at one time or one after another. Or is there relationship between the centers or not. We have the plan of the eye, so to speak, which calls for a distinct center for every function: A definite relationship which is the very life of the organ. And the organs developing step by step representing their stages. What we ask of the experimenter is to identify which is which and the proper relationship of the same. The little we know about the functions of the eye are these: First come the centers for the pupillary contraction; next in order are the centers for the accommodation and are followed by the centers for the convergence. The embryo recapitulates the gradual stages of the organ in its development from the simple to the complex. The processes after birth, evidently, follow the same order. They are the finishing touches of the complexes, and are called "Integration" processes. The reflex arc follows the same

TABLE OF CLASSIFICATIONS OF THE VARIOUS CAUSES WHICH AFFECTS THE PHORIA POSTURE

Systemic:	Physiological—Age (a)		
	Non-Physiological—	Functional (b)	
		Pathological (b)	
	Acquired—	Vocational (a)	
		Ex-anopsia (c)	
		Spasm fatigue (d)	
Local:	Type—	Hyperopic-exophoria (e)	
		Myopic-esophoria (e)	
	Intrinsic—		Hyperopic-esophoria (c)
	Compensatory—		Myopic-exophoria (c)

(a) = Not corrigible by prism.
(b) = Corrigible by prism.
(c) = Subject to trainings.
(d) = Suppression lenses and rest.
(e) = Not subject to trainings, but prisms are permissible only when Rx. is intolerable to wearer (see text).

order; from the simple to the complex. It is the old "Post-Road," so to speak, which has been established by countless of ages.

To return to our subject. In the accompanying table we present the various causes of the phoria in the order of their classifications. The term physiologic should be used with more discretion than it has been used in the past. Age is the only physiological factor present, but its effects are little: A slight amount of eso in the very young; a slight amount of exo in the adult, a little more of exo at the presbyopic age and a little more at near than at distance at the presbyopic age. General debility are common at old age, but it may be present at any age, usually, as the after-effects of sickness. They affect the phoria and we classed them as functional disturbances of the system. Any pathological condition which affects the nervous system in general will affect the phoria of the eye. After we learn more of these effects we will be able to sub-divide the pathological group into finer classifications. In the local sub-divisions, we find the watchmaker, engraver and other craftsmen, who use but

one eye in their work, acquire the habit to let the other eye wander. I class this as vocational exophoria. A similar effect is anisometropia: The ametropic phoria are augmented by the non-use of the poorer eye. Spasm fatigue are present when there is abuse of the eyes: When the tailor works overtime in the busy season, or when the student prepares for examinations at all hours of night, we are justified to assume that there is spasm of accommodation present. When there is no abuse of the eyes, we are not justified to assume that there is spasm of accommodation. The practitioner should stick to the principles that there is nothing haphazard about an eye. The intrinsic factors have been explained before. Complications of the presence of more than one factor are common, and the practitioner should use his best judgment as to the form of treatment. We may speak of these some other time.

DR. N. LEVIN,
101 WASHINGTON AVE.,
CHELSEA, MASS.

OCULAR HEADACHES, ITS DIFFERENTIATION AND MEANING*

B. T. Hoffmann, M. D.,
Chicago, Ill.

Headache is simply a pain in the head, usually relieved by some drug clerk until such time as the patient gets tired taking bromo seltzer or aspirins. It is the most commonly complained of symptom in ailing individuals and also very significant as to its character. A diagnosis should never be made on a headache alone, no matter how expert the attempted location may be. A headache properly analyzed as to time of onset, location, severity or type will offer valuable information as to its possible pathology.

Headaches or cyphalgia have always existed as many trephined skulls are found in ancient ruins. At that time superstition often attributed headaches to evil spirits within the bony wall, and strange to say, the surgeon, wanting to favor escape of such evil spirits by trephining, often succeeed in relieving the intra-cranial pressure and with it the headaches.

How early in life a headache starts, we don't know, some authors claim it to begin at the age of five, which I think to be wrong as many brain diseases have there causes long before that time, not to mention the various ear afflictions of early life. Complaints of pain back of the eye after a slight amount of work and for which hardly any refractive error can be found is often due to hysteria. All kinds of glasses are tried and one man after the other is consulted. The pain or discomfort persists until such time as the attention of the patient becomes focused on some other organ or some operation is performed and the other fellow becomes the ghost.

Headaches of ocular origin should have the following characteristics:

1. Age: Common in school life and up to middle age, hardly ever over fifty.

2. Location, usually frontal or supra orbital. Vertex headaches are not refractive headaches.

*Submitted for publication September 30, 1930.

3. Periodicy, usually later in the day after a period of close application.

I will attempt to describe the commoner causes and types of headaches such as may be confused with ocular headaches or where a patient consistently complains of pain within or around the eyes.

Earliest manifestations of pain or disturbances are not always due to diseases in the organ so affected, but are often found in organs remotely distant, but in a general way depending upon it for proper functioning. Dizziness in the head or fainting spells from too much or too little blood in the brain, cold feet or hands, may all be the first manifestations of disturbances of the heart.

Every case presenting itself for refraction with a history of headaches should be carefully questioned as to whether he easily gets tired or winded, suffers from dizziness or, whether hands or feet get cold easily. Such manifestations are very commonplace and are as a rule never connected by the patient with ocular symptoms.

It is a well known fact, that cases often presenting the least ocular symptoms have greater constitutional disturbances. Quick fatigue or exhaustion often are associated with more or less unstable emotional conditions as great irritability, blues, depressions, morbid fears, bad dreams, car and movie fatigue, etc., and are often subject to cure or great amelioration of symptoms by a carefully worked out refraction.

Some astigmatism is mostly always found but not all astigmatism causes symptoms and it requires a combination of circumstances and a suitable temperament before harmful results occur.

Focal, general, specific infections or general toxemia will bring about ocular diseases more easily, if to the sum total, reasonable eye strain is added.

People who for years have been hearty and strong, never complaining of their eyes, will very easily do so after some taxing sickness, operation or depression overcomes them and who often not regaining their former health or strength for some time. It is in just such cases, where seemingly slight errors of refraction properly corrected, often do a world of good and usually correct the irritability and early fatigue.

Functional nervous headaches are often found in people with high strung temperaments. From the history of the patient such are easily recognized as nervous headaches following excitement, social ordeal, domestic disagreements, financial difficulties, severe sickness or death to a member of the family, etc.

Headaches suffered from nervous exhaustion are usually in the central, basal portion of the head and mostly involving the eyes. The storage battery of nerve cells has been drained so completely, that over fatigue is corrected by absolute rest. Such headaches are usually not relieved by drugs.

Over indulgence is responsible for headaches in many people, whose vital energy is not equal to their ambitions. Formerly such headaches were considered as neuralgic, but we have since learned the neuralgia or rheumatism are the most abused words in etiology and cover a multitude of sins. Today we classify neuralgia pains under two headings, namely: Sinus disease and referred pains.

Headaches due to intra-cranial pressure are of more or less severity, as the dura mater is supplied with sensory nerves and therefor easily influenced by pressure of any kind. Headaches caused by febrile diseases, of nephritis or other toxins affecting the osmotic pressure, will easily cause a slight oedema of the dura and thereby affect the entire central nervous system. With our ever increasing use of autos and consequent gas consumption, inhaling of carbon monoxide, though in small quantities, will easily cause persistent headaches.

A neurasthenic will get a headache a few minutes after starting to read. Such pain is in the eyelids, the eyes proper or back in the head, while in cases of refraction or muscular anomolies considerable time at work or reading elapses before pain or discomfort starts.

Toxic headaches vary in degree from a slight dull heaviness to intense stupifying pain. All toxic headaches have essentially the same quality and characteristics, involving extra and intra-cranial structures. There is no special localization of pain except greater severity in the vertex region, generally over the entire head according to the degree of toxicity, but steady, continuous and very depressive. It dulls the faculty and produces mental hebetude. Severe constipation with its toxic absorption is one of lesser severity while uremic toxemia is more severe and attains a degree of mental stupor and even death.

Vacular headaches. The old conception that, "rushing of the blood to the head," causes a headache, is wrong, as even a general elevation of blood pressure does not usually cause a headache. Cases of hypertension due to neurotic or endocrine disturbances may cause a headache which however is more due to abrupt elevation of pressure and toxemia as in many cases of nephritis and arterio-sclerosis.

Syphilitic headaches are virtually toxic headaches and may be classed as such. Secondary syphilis attacks the cranial bones and causes a constant headache.

Tumors or gummata are usually at the base of the brain or fronto parietal region, are constant and have definite pressure symptoms with motor nerve disturbances of the region affected. Such headaches are very severe, lasting day and night and only partially relieved by opiates. It is here where the ophthalmoscope and careful observation with the opthalmoscope is very valuable in the diagnosis.

Ocular migraine, hemicrania or sick headaches are usually recurring headaches common in high strung individuals always starting

on one side of the head, finishing on both. It is recognized by its prodromal symptoms, as flashes of light, temporary scotomata, muscae volitantes and hallucinations of all kinds. Many ghost stories have their origin in the prodromal symptoms of migraine. Migraine is often caused or at least aggravated by chronic ethmoidal infections.

Headaches under such are more common than we usually realize. Headaches with such infections are more of the heavy depressing kind and located deeper in the head. There may be momentary shooting pains to the temples, rather severe but of short duration.

Headache is also attributed to digestive disturbances and no doubt occurs. Such headaches are usually due to hyperacidity.

Anemia will cause headaches due to the slightest exertion as such patients have very little resistance because of its poor blood quality and are subject to severe nerve fatigue at the least effort of any kind.

Headaches associated with diabetes are due to acid intoxication. We really don't know why a patient can't use his sugar properly. A normal individual can consume several ounces of sugar without any trace in his urine while a diabetic will show such, consuming one-half ounce or more. Acidosis is the final cause of his weariness, fatigue, headache coma and death. Proper diet does much, but alkalinization of the blood will help most.

Cerebral anemia, due to impoverished or perverted supply of the blood and a cry of starving nerve for blood. Such headache is intense or constructive in character, giving the sensation of the head being tightened in a vise. The muscles of the scalp are sensitive to the touch. Many so-called migraine headaches may be in reality due to cerebral anemia. In such cases the fundus picture will show anemia of the retina.

Heterophoria. It is a mistake to assume that eye strain is only associated with the ciliary muscle. Patients having hyperphoria without complaining, are lucky in possessing a strong nervous system and are also physically strong, otherwise they soon complain. Headaches due to hyperphoria are relieved by sleep, while pain due to sinus disease will not yield to rest, or at least as long as pressure keeps up.

Cyclophoria will easily cause vertigo and nausea as long as both eyes are being used. Esophoria will cause about the same symptoms as hyperphoria. All brain nuclei are disturbed by it and binocular vision made difficult. Exophoria will mainly cause blurring of letters at the near point after prolonged use of the eyes. There will be a heavy or stiff feeling of the upper lid.

Exophoria may cause a chronic congestion of the eyelids.

The point we must absolutely bear in mind is that any muscular anomaly should be promptly recognized and treated so as to make the movements of both eyes normal and of no particular effort. Eye strain or muscular strain causes a great variety of symptoms often

remote from the eyes and patients who had been nervous wrecks before had no idea that their eye muscles had anything to do with it.

Equilibrium or orientation is necessary to maintain the proper mechanical relation of the body to its surroundings. Our recognition is regulated by sense organs, especially sight, next, hearing and the function of the labyrinth. The different nerve endings in the skin, muscles and joints assisting greatly. Co-ordination is mainly secured by a variety of nerve path associations and is usually voluntary, that is, by individual effort, to make these movements or maintain the position in question. These we call acquired co-ordinations, while those we have from our ancestors are inherited co-ordinations.

The group of associated nerve paths and nerve nuclei plus our voluntary effort enables the aviator to keep his balance in the air and the automobile driver to judge instantly to avoid collision. Of course to have and maintain quick jugment we must have a normal and instantaneous acting muscular eye apparatus, plus good sight and fusion. Where such is weak or faulty, muscular exercises, based upon a careful examination, will do more towards a cheerful disposition than anything else I know of. Where the refractive error is small, glasses are more of assistance than primary importance. Any one of the more modern units for muscular exercises will be of great benefit and above all a great time saver. Nothing is more distressing than the inability to use both eyes with comfort at the near point or in other words to be constantly "eye conscious." This is not confined to any particular age, but more prevalent from adolescence to middle age.

Systemic Headaches. The commonest is from the stomach usually hyperacidity of alkalinity, acidity is quickly relieved by sod bicarb while alkalinity by diluted hydrochloric acid. Intestinal stasis is by far the most common cause of headache, usually due to absorption of its bacterial toxin often very quickly relieved when the bowels are moved. It is both a toxic and neurotic headache. Gouty and rheumatoid headaches are of the systemic group, usually only extra cranial, painful to the touch and aggravated by movements of the head.

Gynecological Headaches. The old erroneous idea that the physical life of a woman is more prone to headaches due to her genital organs and functions is wrong. Females are only human beings as men are and such headaches are either toxic or neuralgic. We have, however, some headaches peculiar to the female organs, such as menstrual headaches, which, strictly speaking, are of endocrine origin and more or less neurotic.

The most common headaches confused with ocular origin are the nasal headaches or those caused by its accessory sinuses. The sinuses are supplied by the fifth nerve and any pressure by pus, etc., on the mucous membrane will cause severe neuralgia-like pains. An occluded entrance to a sinus causing absorption of the air, forming a vacuum, will have the same result.

No more intimate relation would exist than between the nasal accessory sinuses and the eye. The mucous membrane is of the same structure and closely associated. Nasal accessory sinuses are primarily air chambers and sound chambers and consequently disease and pain will result in proportion to their interference of function.

I will attempt to describe briefly the various pains of the orbit, usually due to nasal accessory sinus infections.

Frontal Sinus. Any condition or disease which will close the frontal duct will cause frontal sinusitis. Acute rhinitis, influenza or tonsilitis are the more common causes. Inflammation of the ethmoidal cells, enlargement of the turbinate bones or deflection of the septum are predisposing factors. Polipy are more often due to the discharge from a diseased sinus than the causative factor to sinus infection.

The area most likely to yield to pressure is the inferior wall which often causes oedema and even ptosis of the upper lids.

The pain is dull and severe over the sinus and often referred to the center of the forehead, radiating to the mastoid and occipital regions. Coughing and blowing the nose increases the pain, stooping over will do likewise. Frontal sinus affections make the patient more or less dizzy. Pressure over the sinus or tapping it with the forefinger increases the pain.

The pain is most severe in the morning, decreasing as soon as gravity in the upright position drains sufficiently to relieve the pressure. Drooping and swelling of the upper lid is very common. The conjunctiva is usually congested on the same side. The pain may also be very severe due to a vacuum of the frontal sinus, that is, there being no infection, just a mechanical closure of the duct by swelling and pressure. The air in the sinus becomes absorbed and severe congestion takes place in the cavity causing the pain. Such conditions are promptly relieved by shrinkage of the swollen nasal structures. This condition is called the "Sludar Syndrone."

The Maxillary Sinus or Antrum. The pain is dull and pressure-like in character over the affected side of the face. It may also radiate to the occiput, neuralgic in character and increases towards the end of the day. These patients will complain of frequent colds.

In sphenoidal and ethmoidal disease we have peculiar heaviness and pain in the eyes with poor drainage to the lachrymal duct. The eye may have a swollen conjunctiva, swollen lids and photophobia. Visual disturbances or field changes may easily take place due to involvement of the optic nerve or uveal tract.

If the turbinates become swollen from any cause, less air enters the sinuses, the patient becomes a mouth breather and the pharynx is secondarily affected adding to the misery. Simple catarrhal infections are characterized by mild headaches, stuffy nose and a fairly constant mucoid discharge, becoming thick and yellow at times.

The more we study diseases the more we come to the conclusion that it is impossible to draw sharp lines as mucous membrane inflammations spread to neighboring structures and there is often a combination of one or more sinuses involved.

A characteristic feature of nasal headaches is its incidence. It will occur chiefly when the head is low, or when the nose is irritated by pollen or chemical substances.

The spacious cavities in the skull, often widely separated, are really projected into one another when an X-ray picture is taken, making interpretation very difficult.

Transillumination, while not reliable, has certain advantages over X-ray, if the bony wall is not too thick. Transillumination and X-ray are diagnostic points supporting the diagnosis, but not establishing it. The amount of pus discharge has no relation to the severity of the pain or infection.

Next in frequency to nasal headaches are the ocular headaches and for convenience, we may divide them into two classes:

1. Due to functional eye strain.
2. Due to diseases of the eye.

The functional or refractive errors are by far the most common. Some refractive errors have a predilection of pain as follows:

Hyperopia—frontal or brow,

Astigmatism—temporal or occipital,

Muscular—deep seated pain in the orbit, eyes and temple,

Myopia—of a high degree may cause a dull headache, but usually none.

It is best not to pay too much attention to the location of the pain, more so, to time of onset. Naturally such pain depends upon the use of the eyes, and is worse after continued close application, usually later in the day, lasting until bedtime, disappearing at night. Severity of an ocular headache does not depend upon the magnitude of the refractive error. It depends upon the effort, usually unconscious by the patient, to correct it and strange to say, its susceptibility is usually greater in small degrees of error of refraction.

Of headaches due to ocular diseases, two are most important, namely: Glaucoma and Iritis. Further, others such as retro-bulbar neuritis are very important pathologically, but not nearly so as to pain.

Glaucoma is a disease coming at an age when wear and tear, vicissitudes, exposures, overwork and careless living have sapped the physical endurance of life. Infections have an easier play and toxic and other influences may very easily change the pathological aspect to associated uvititis, retinitis, high blood pressure, etc. Glaucoma is a syndrome complex of which tension and its accompanying pain is the chief feature.

Premature cases of presbyopia and subnormal accommodation should be always carefully examined for tension. A deep physiological cupping may possibly predispose to glaucoma, but such is not proven. Cupping is a deciding and cardinal symptom but comes late in the disease whenever a retinal vessel dips sharply over the margin of the disc, a very careful examination of other glaucoma symptoms should be made. Fields should be often taken for comparison.

Whenever a patient comes complaining that his glasses need changing every few months, look out for tension. He may have an occasional super orbital pain and associate such with neuralgia. A slow acting or dilated pupil with a shallow anterior chamber is very suggestive and mostly diagnostic. A beginning cataract with its swelling of the corticular portion of the lense may at times produce a slight tension, but such is hardly ever detrimental.

The much feared idea of a cycloplegic causing glaucoma is very over-estimated, as it only aggravates existing, but perhaps not noticed conditions in an eye with periodic or slight tension. Any eye which develops glaucoma after cycloplegia is going to develop glaucoma sooner or later anyway. I don't know of any ocular disease requiring the ingenuity of the opthalmologist more than glaucoma. There are no set rules and each case must be studied on its merits. Often myotics have to be combined with surgery and in spite of all, the results are very poor in the long run. The optometrist of today must be familiar with signs and symptoms of glaucoma, as he is the one who first hears of the patient's visual defects and troubles.

Iritis. The iris, ciliary body and the choroid constitute the uveal tract and should be considered as one disease as far as pain is concerned.

The pain begins with general discomfort which increases to a distinct ache referred to the brow immediately above the eye. We have at this time a peri-corneal injection, first pink, becoming more pronounced as the disease advances. At this time, we have discoloration of the iris, loss of lustre, swelling and contraction of the pupil. Pain becomes more severe and worse at night. If the cyclitis is severe, the eye will be very tender upon pressure.

In chronic cases, the eye is said to be very irritable. The greatest danger lies in the adhesions of the iris to the anterior lense capsule and its occlusion by albuminous exudate (Occlusio Pupillae).

Cases of iritis must have immediate attention as otherwise the damage caused within a few days is irreparable.

Optic neuritis or retro-bulbar neuritis is often due to an extension of inflammation of the ethmoidal or sphenoidal cells attacking the sheath of the optic nerve. It is characterized by field changes and may have popillitis if severe enough.

Pain is deep seated in the orbit, aggravated by movements of the eye ball.

Foreign bodies in the cornea are very aggravating and painful and if not promptly removed may be the cause of a severe corneal infection.

Keratitis—not necessarily due to foreign body is a serious affliction and may become very painful. As soon as a portion of the corneal epithelium is lost, the nerves in the cornea are exposed and irritated causing considerable pain and photophobia.

An ulcer is considered simple when not surrounded or infiltrated with disintegrated tissue. Ulcers not properly treated will leave severe nebulae or even go on to perforation with incarceration of the iris.

DR. B. T. HOFFMAN,
55 E. WASHINGTON ST.,
CHICAGO, ILL.

A CASE OF HYPEROPIC ASTIGMIA WHICH DEVELOPED INTO COMPOUND MYOPIC ASTIGMIA*

Arne T. Wray, Opt. D.
Los Angeles, Calif.

The patient L. I. was brought to us when he was twelve years of age as he had been told in school that he needed eye attention, and as will be seen from the digest given below of the several examinations, was given plus .50 D. cylinders. Since his examination in 1927 the outstanding ocular complaint was an intermittent clearing and blurring of vision.

It will be noticed that since 1928 there has been a gradual reduction in vision without lenses. It was at this time that he became very active in high school athletics and became a track runner for his school team. The variations in the ophthalmometer readings and the manifested myopia, together with the clearing and blurring of vision all pointed toward some functional disturbance, but from the history of the case the patient seemed to be a normal, healthy, intelligent youngster.

In 1929 the perimetric charts verified the presence of some functional disturbance and a reduction in athletic activities was advised, but the school physician after a very cursory examination of the heart, pronounced him in fine shape and advised him to continue his work on the track team.

In July, 1930, I was finally successful in persuading the parents to have the boy examined by a thoroughly reliable physician who found a bad heart condition resulting from the strain of the athletic activities and an extremely hyperthyroid condition. The boy at this time was so nervous that he could not sit quietly in the refracting room for more than ten or fifteen minutes at a time.

According to Pottenger "Symptoms of Visceral Disease" (page 189), the heart is activated by the sympathetic nervous system. The toxemia resulting from the hyperthyroid condition also irritates

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the sympathetic nervous system, and it is the hyperstimulation of this branch of the nervous system which most likely produced the manifested myopia in a case which up to thirteen years of age was hyperopic.

This case evidences most forcibly the perniciousness of the American high school and college athletic systems which encourages the growing child to strain himself, perhaps injuring himself for the rest of his life as this boy did, in order to bring glory to the institution.

Oct. 17, 1925:

Vision: OU 20/20 O. D. 20/20— O. S. 20/20—
Age: 12 years.
Ophthalmometer:
O. D. 5°/44.37 95°/45.37
O. S. 175°/44.75 85°/46.5
Static Skiametry:
O. D. + .50 + .50x90
O. S. + .25 + .50x90
Dynamic Skiametry:
O. D. + .75 + .50x90
O. S. + .75 + .50x90 (first neutralizing lens)
Subjective:
O. D. — .25 + .50x110
O. S. + .50 cyl.x90
Tonicity at 20 ft: Trace of right hyperphoria.
Physiologic exophoria: Not taken.
Abduction at 20 ft.: 6/4
Adduction at 20 ft.: 16/6
Right supraduction (20 ft.) 3/2; right subduction 2/0.
Rx prescribed: O. U. + .50 cyl.x90.

April 11, 1927:

Vision: O. U. 20/20 + O. D. and O. S. 20/20
Ophthalmometer:
O. D. 175°/45.00 85°/45.75
O. S. 175°/44.5 85°/45.25
Static Skiametry:
O. D. — .87 + 1.00x90
O. S. — .62 + .75x90
Dynamic Skiametry:
O. D. + .75 + .50x100
O. S. + 1.00 + .25x 90 (first neutralizing lens)

Subjective:
O. D. — .25 + .50x100
O. S. — .25 + .50x 90
V. A. OU 20/20 plus

Tonicity at 20 ft: 1$^{\Delta}$ exophoria with a trace of right hyperphoria.
Physiologic Exophoria: 5$^{\Delta}$ to 7$^{\Delta}$ exo.
Abduction at 20 ft: 6/5.
Adduction at 20 ft: 12/4.

Rx: Same as previous. Gave orthoptic treatments with phenomenal success—ductions raised considerably in three treatments.

May 12, 1928:

Vision: OU 20/20-3 O. D. 20/20 O. S. 20/30-2

Ophthalmometer:
O. D. 170°/44.5 80°/46.00
O. S. 180°/44.00 90°/45.5

Static Skiametry:
O. D. — .25 — 1.00x180
O. S. — .25 — 1.00x180

Dynamic Skiametry:
O. D. + 1.00x90
O. S. + 1.00x90

Subjective:
O. D. — .50 + 1.00x90
O. S. — .25 + .50x90
V. A. OU 20/20

Rx: Had him continue with the same correction as I was very much puzzled about the case. I felt sure that there were some systemic disturbances which were causing the changes in the ophthalmometer readings and in the refraction.

October 20, 1928:

Vision: OU 20/20 plus O. D. 20/30-1 O. S. 20/40

Ophthalmometer:
O. D. 172°/44.5 84°/45.75
O. S. 180°/44.25 90°/45.00

Static Skiametry:
O. D. — .25 — 1.00x175
O. S. — .25 — 1.25x 15

Dynamic Skiametry:
O. D. — .25 + 1.00x85
O. S. + .75 cyl.x15

Subjective:
O. D. — .50x180 V. A. 20/20
O. S. zero V. 20/20, clearing and blurring intermittently.

Tonicity at 20 ft: 1Δ right hyperphoria
Abduction at 20 ft: 8/6
Adduction at 20 ft: 26/24
Vertical ductions at 20 ft: Left supraduction 3.5/2.5. Left subduction same.

Physiologic exophoria: 4 exo.

Rx: 1.5Δ base-in each eye, which was reduced to 1Δ base-in each eye since the first bothered him. This was given in an effort to obtain relaxation of the ciliary hyperactivity as was evidenced by the fact that the vision of the left eye was 20/40 at the beginning of the examination and 20/20 after the reduction of fogging lenses.

June 22, 1929:

Vision: OU 20/30— O. D. 20/50 O. S. 20/100 clears and blurs
Ophthalmometer:
O. D. 175°/44.62 85°/46.00
O. S. 5°/44.5 95°/45.37
Static Skiametry:
O. D. — .75 — 1.00x180
O. S. — 1.25 — 1.25x180.
Dynamic Skiametry:
O. D. — .25 + .75x90
O. S. — .25 + .75x90
Subjective:
O. D. — .25 — .75x180
O. S. — .50 — 1.00x180
V. A. OU 20/20

Tonicity at 20 ft: 1Δ exophoria 1Δ right hyperphoria
Abduction at 20 ft: 8/7.5
Adduction at 20 ft: 18 blur, break at 19 refusing to and holding to 35, recovery at 30.

Rx: O. D. — .25 — .75x175 O. S. — .50 — 1.00x5. Combined with ½Δ base up. Perimetric charts show very much enlarged green fields indicating stimulation but history does not reveal source and parents unwilling to have physical examination.

May 24, 1930:

Vision: OU 20/50— O. D. and O. S. 20/100—
Ophthalmometer:
O. D. 175°/44.5 85°/46.00
O. S. 180°/44.12 90°/45.75
Static Skiametry:
O. D. — 1.00 — 1.50x175
O. S. — 1.25 — 1.25x180

Dynamic Skiametry:
O. D. — 1.25 + 1.50x85
O. S. — 1.25 + 1.25x90

Subjective:
O. D. — .75 — 1.25x175
O. S. — 1.25 — 1.25x180

Tonicity: 1Δ exophoria and 1Δ right hyperopia.

Rx: Refused to change the lenses and insisted upon a thorough physical examination by a physician in whom I had confidence. Perimetric charts show enormously large green fields outside of blue.

July 24, 1930:

The following correction was given after having received report from physician in which a diagnosis of hypertrophied heart (athlete's heart) and toxic hyperthyroidism was made. Metabolism test running between plus 53 and plus 100. Physician's prognosis: Invalidism unless patient follows rigid diet, and abstinence from all physical exercise for at least a three months' period.

O. D. — .50 D. Sph ⊃ — 1.25 D. Cyl. x 175 ⊃ ¾Δ base-in ⊃ ½Δ base down.

O. S. — .75 D. Sph ⊃ — 1.25 D. Cyl. x 180 ⊃ 1Δ base-in.

DR. ARNE T. WRAY,
3204 W. SIXTH ST.,
LOS ANGELES, CALIF.

DIPLOPIA IN THE TREATMENT OF STRABISMUS*

Joseph I. Pascal, B. Sc., M. A.
Vienna, Austria

The treatment of strabismus was for years and years associated primarily with the idea of fusion exercises. Many ingenious devices were constructed for the purpose of developing single binocular vision. Of course this is the ultimate and desired, namely the establishing of single binocular vision. But in the process of attaining this goal one of the most fundamental factors in the natural development of single binocular vision was overlooked. This factor is the presence of *diplopia* as a stage of *preceding* the development of single binocular vision. It is gratifying to note that the recognition of this knowledge is now making headway as evidenced in recent publications, e. g., in the discussion on Strabismus by Drs. McCulloch and Hathaway in the recent issue of the American Journal of Optometry.

Binocular single vision does not develop as a luxury. It develops as a necessity in order to escape from the annoying diplopia. The child begins life with a pair of un-coordinated or but slightly coordinated eyes. Seeing double is natural to him and causes no disturbance until he begins to coordinate his visual impressions with his other impressions. Then the trouble begins. He sees two toys but he can only grasp one with the result of an inner disturbance. If the vision of one eye is very poor he will ignore one image and thus remove the cause of his disturbance. This will naturally lead to continued monocular vision with a permanent squint. Or when the vision in the two eyes is equally good he may alternately ignore one image and thus develop an alternating squint. In the vast majority of cases, however, he solves the problem of the annoying diplopia by blending the images and attaining single binocular vision.

Now this natural process in the development of single binocular vision must be resorted to in the treatment of a case of strabismus.

*Submitted for publication September 3, 1930.

Diplopia must be aroused. *Exercises in diplopia* are more fundamental than exercises in fusion. Some years ago when I first presented this idea of diplopia exercises, even some well informed men told me it was an absurd idea. I let it go at that. I knew that it takes years for a new idea, a new mode of treatment to be taken up, and bided the time.

That this idea is now taking roots is evidenced in a number of ways. Last year an English optometrist wrote to me for some suggestions in connection with an instrument he was experimenting on for the purpose of carrying out my ideas conveniently in clinical work. Constructing an instrument for this purpose is very praiseworthy, but there are some ways of carrying out this work even with the means now at the disposal of the optometrist. Some suggestions for such work were presented in a lecture in Boston and in Chicago early in 1928. Further suggestions on this phase of diplopia were presented in a lecture at the London Refraction Hospital early last year and are incorporated in a brief article on the subject in the London Optician of May 2, 1930. However, the important point is the recognition of the soundness of this procedure. The rest will follow.

DR. J. I. PASCAL,
c/o AMERICAN EXPRESS CO.,
KARNTNER RING, 14,
VIENNA, AUSTRIA

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EDITORIAL STAFF

DR. CAREL C. KOCH, Editor
1501 Foshay Tower
Minneapolis, Minn.

DR. JACK I. KURTZ, Associate Editor
1501 Foshay Tower
Minneapolis, Minn.

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ON THE DOUBTFUL PROCEDURE OF TREATING REFRACTIVE ERRORS WITHOUT LENSES

From time to time the subject of curing or relieving the effects of refractive errors without the use of lenses is brought forward. Waves of enthusiasm for these ideas seem to pass over the country and during such a period much is heard about the advantages of using this or that technique, which it is claimed, when carefully followed will enable the patient, who in the past has had to wear glasses, to get along without them. We here in America are just passing through a period of this kind and evidently the peoples of England have experienced a similar period for in the recent issues of the *Optician* (published in London), there are now appearing a series of papers by Dr. J. Ross-Mansell, B. Sc., Ph. D., dealing with a number of these theories and their results. Ross-Mansell has carefully checked with negative results, first the various theories and second the results as obtained by the application of these theories on patients themselves, and he gives a number of clinical case reports showing the results of these techniques. The following are typical:

Case 1.

Mr. J. R. M., Essex. Aet 31.

Rx. O. D. — 5.25 sph. — 0.50 cyl. ax. 90
O. S. — 5.25 sph. — 0.50 cyl. ax. 45

Correction prescribed by surgeon, October 20th, 1929.

System Used: Pearce.—The massage appliance was not employed.

Result: Marginal hyperaemia of the lids and occipital headaches after three weeks of the treatment. Treatment continued, however, although headaches persisted. No improvement in vision.

Case 2.

Dr. M. C., Catford. Aet 28.

Rx. O. D. — 1.0 sph. — 1.50 cyl. axis 90
O. S. — 5.50 sph. — 0.50 cyl. axis 30

Has worn glasses since the age of seven. At that age had convergent squint. Operated on. Convergent squint now markedly divergent. V. A. squinting eye 6/18, V. A. normal eye 6/6. Last refracted May 7th, 1930. Corrective treatments carried out during the last three years have proved unsuccessful.

System used: Pearce.

Result: Vision O. S. slightly worse. No change O. D.

Case 3.

Dr. S. S., Hampstead. Aet 33.

Rx. O. D. + 5.50 sph. — 1.25 cyl. ax. 10
O. S. + 3.75 sph. — 2.25 cyl. ax. 160

Last refracted March 2nd, 1930.

System used: Pearce. Macfadden.

Result: Has accepted reduction of 0.50 sph. O. D., probably due to over-correction in first instance.

Case 4.

Mr. V. M. G., Brixton. Aet 32.

Rx. O. D. + 1.25 sph.
O. S. + 1.25 sph. — 0.25 cyl. ax. 20

Last refracted July 15th, 1929.

System used: Pearce.

Result: Claimed that he was able to discard the glasses. Examination showed that uncorrected vision was O. D. 6/9 +; O. S. 6/9. States that he can manage quite well without glasses, but uses them "off-stage" for reading.

Case 5.

Miss E. C., Finsbury Park. Aet 19.

Rx. O. D. — 6.50 sph. — 2.0 cyl. ax. 35
O. S. — 7.0 sph. — 1.25 cyl. ax. 15

Last refracted April 10th, 1930.

System used: Pearce.

Result: Marginal hyperaemia and conjunctival injection. Persistent headaches. Treatment suspended for a few weeks, and then continued without massage appliance. No improvement of vision.

It is obvious from Dr. Ross Mansell's findings that the success arrived at by those practicing these therapies in England just about equals the success of those who become involved in this type of quackery in America. It has always been doubtful indeed whether anything at all can be accomplished by means of these therapies in the way of correcting true refractive error, and the findings of Dr. J. Ross-Mansell indicate that this doubt was well founded .

C. C. K.

ABSTRACTS

LIGHT CHANGE GIVES NEW ATOMIC VIEW. R. W. Wood. The Optician. (British). Vol. LXXVI, No. 1963, p. 211.

A very recent discovery by a Hindu scientist, Professor C. V. Raman, that intense light of a single color is partly changed to other colors when it shines on various transparent substances opens up a wholly new field in the study of molecular structure. This statement was made recently by Prof. R. W. Wood, of the Johns Hopkins University, in announcing that he had completely verified Professor Raman's discovery.

According to Wood, who has just completed an investigation of the subject with improved apparatus and a more powerful spectroscope than the one employed by Raman, the effect occurs when monochromatic light, which is light of a single color, and, unlike white light, is entirely of a single wavelength, shines on transparent substances such as quartz, chloroform or water. The light that is scattered from the material is mostly of the same color, or wavelength, as that of the light illuminating it. The spectroscope, the instrument that analyzes light, shows, however, that part of the light is changed to wavelength a little longer or a little shorter than the source. On the spectrum photographs the result is a heavy line attended on either side by narrower and fainter lines. The fainter groups of lines on one side are the same as those on the other, except that they are reversed, as if reflected in a mirror, the center line being the mirror. Raman found only a single and very faint line on the high frequency side of the exciting line, but Wood has found groups of lines on this side almost as strong as the groups on the other in the case of carbon tetrachloride and chloroform.

The importance of the discovery comes from the fact that the difference between the frequencies of the light given off, and those of the light which shines on the substance, is precisely the same as

the frequencies of the absorption bands of the same substance for infra-red light—light which is vibrating too slowly to be seen or even to be recorded on the photographic plate without great difficulty. By means of the Raman effect, the physicist can now study these bands of absorption indirectly. Wood also pointed out that the effect was one of the most convincing proofs of the quantum theory of light, which supposes that light consists of separate pulses, or "quanta" rather than waves, as was formerly supplied. Only by the quantum theory, he thinks, can the effect be explained.

Most of his research was done with crystalline quartz, or such liquids as chloroform and carbon tetrachloride, illuminated with a mercury vapor arc lamp. He is now planning to repeat the work with a spectroscope of 40 feet focus, which will give even more convincing results than those he has now obtained.

T. O. B.

ON SYSTEMS OF PLANE REFLECTING SURFACES. T. Smith. The Optician. (British). Vol. LXXVI, No. 1928, p. 232.

Systems of plane reflectors, usually arranged to deflect light while it is within a block of glass, are of considerable importance in certain types of optical instruments. The properties of such systems can readily be exhibited graphically when the normals to the various surfaces are coplanar, but in more general examples graphical methods are apt to prove troublesome. The usual method of investigation is then to calculate the properties of the system by spherical trigonometry. In the endeavor to break away from this method Captain Baker has lately resorted to drawing on a sphere. The details of his procedure, in so far as they relate to the directions of the rays, have been described in another paper. For a rapid preliminary survey of the types of construction which may be employed to secure a given result, this method has much to recommend it, but, like all graphical methods, it can hardly be expected to yield the accuracy essential for optical work. Ultimately the alternative to a trigonometrical is an algebraic method, such as we now proceed to describe.

Smith in this paper proceeds to use the optical property that the distance between an object point and its image in a plane mirror is twice the distance of the object point from the plane, and expresses this property mathematically by means of two determinant matrices.

By the use of these matrices Smith is able to express various conditions which must be fulfilled if the systems of reflectors are to have certain properties, for example (1) the condition of no dispersion or that the prism system is equivalent to a parallel plate;

(2) the condition for total internal reflection at any particular surface; (3) the boundary conditions, that is those necessary to ensure that light incident at certain points in specified directions will be transmitted and emerge in the directions required.

The Classification of Reflecting Systems is then dealt with.

The primary division it is natural to make is that between systems in which the total number of reflections is even and those in which it is odd. These main divisions may be divided again according to the nature of the self-conjugate locus. This locus may consist of: (1) the whole three-dimensional field, (2) a plane, (3) a straight line, (4) a point, (5) no point at a finite distance. He considers each of these classes briefly in turn.

After some remarks on the solution of the Matrix Equations and on some practical calculations, Smith concludes:

"From the foregoing examination it is apparent that systems of reflectors may be either designed or analyzed rapidly and with little trouble by the algebraic method, which is free from difficulties arising from uncertainty in the sign of angles such as have been found in trigonometrical methods of investigating these systems."

T. O. B.

THE ACUITY OF NEAR VISION. Editorial. The Refractionist. (British). Vol. 17, No. 250, p. 321.

This annotation points out that as a rule visual acuity at the patient's occupational near-point is somewhat better than for distance. That is to say, a person who can read at 6 meters No. 6 type, which is 8.75 mm. in diameter can at 1 meter read type which is smaller than one-sixth of 8.75 mm. or 1.46 mm., or he can read this smaller type of 1.46 mm. diameter at a greater distance than 1 meter. The influence of any changes within the eye can very well be ignored, and the reason for this apparently better sight in near as compared with distant vision would appear to be that the illumination is better in near vision, and perhaps the greater contraction of the pupillary area tends to sharpen the retinal image.

T. O. B.

ANNOTATIONS AND SOCIETY PROCEEDINGS

The American Journal of Optometry is the Official Organ of the American Academy of Optometry, as well as the Organ of the Arkansas, Delaware, Indiana, Iowa, Maine, Maryland, Michigan, Minnesota, Nebraska, North Dakota, Oklahoma, Pennsylvania, South Dakota, Vermont and West Virginia Optometric Associations.

The following gentlemen have consented to supply items of interest from their respective sections, acting in the capacity of

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THE ACADEMY CONVENTION

The American Academy of Optometry Convention was held at Omaha, Nebraska, Hotel Fontenelle, December 14, 15, and 16th. The meeting opened with an address by the chairman, Dr. Briggs Palmer of Boston. A number of interesting and instructive papers were read and discussed. The Correction of Squint in the Dominant Eye, by Dr. George Oertel; The Form and Function of the Visual Tract, by Dr. Eugene Wiseman; Accommodative Convergence Relationships, also some clinical and statistical data on lenticular astigmatism by Dr. Edwin Forbes Tait; Color Field Work, by Dr. J. Wolff; Recent Discoveries in Anatomy, Physiology and Psychology of Interest to Optometry, by Dr. R. M. Peckham; Practical Ideas from a Practical Standpoint, by Dr. Clyde C. Hathaway; Minimum Optometric Procedure, by Dr. S. S. Titus; Orthoptics, by Dr. R. E. Littlefield; Phorias and Duction Tests and Their Significance, by Dr. A. M. Skeffington.

The annual formal dinner took place on the evening of December 15th, Dr. Briggs Palmer acting as toastmaster. The dinner was followed by a debate: "Resolved That Ocular Physical Therapy Should Be Applied by Optometrists." Dr. J. I. Kurtz presented the affirmative and Dr. C. R. Padelford the negative.

The following officers were elected to serve during the year 1931: President, Dr. Walter I. Brown, New Bedford, Mass.; Vice-president, Dr. O. J. Melvin, Omaha; Secretary and Treasurer, Dr. J. Fred Andreae, Baltimore, Md. The executive committee members elected

are: Dr. J. W. Jarvis, Buffalo, N. Y.; S. S. Titus, Kansas City, Mo.; Robert N. Walker, Winston Salem. N. C.; and Dr. E. B. Alexander, Duncan, Okla.

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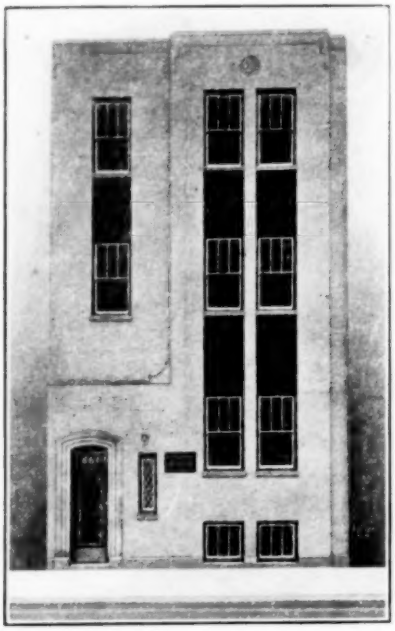
THE POST GRADUATE INSTITUTE

A dream and a vision of forward looking optometrists has come true with the opening of the first Post Graduate Eye Institute in America. Drs. Mendelsohn and Shepard, who conceived the idea and the founders of the institute, are to be congratulated upon their success in carrying through their aim and ideal to a successful start. Indeed, optometrists from all over the country joined in extending their best wishes to this new optometric institution, to the founders and the staff.

Organized optometry, as well as individual optometrists, have much to gain from the Post Graduate Eye Clinic. The amount to be gained will be in direct proportion to the amount of co operation and encouragement the optometrists will give to the founders and faculty of the institute.



The three-story building provides a class room comfortably seating about fifty persons, a library or study, a dark room, a lounge, business offices, stenographic and correspondence offices, and, on the first floor, the information desk, delightful reception room, consultation office, completely equipped examination rooms and treatment rooms.

On the lower floor, entered by a separate stair from the vestibule, a room has been prepared for a charity optometric practice. This room was offered to, and has been accepted by the Chi Chapter of the Beta Sigma Kappa Fraternity for the purpose of conducting an optometric practice for charity service. The charity practice will be conducted by the fraternity, entirely apart from the activities of the Post Graduate Eye Institute. There are in all sixteen rooms devoted to the latter.

The subject-matter of all instruction provided by the Post Graduate Eye Institute will be subject to the approval of a board of ten advisers, representing every ethical aspect of the practice of Optometry in every part of the United States.

The Post Graduate Eye Institute extends an invitation to all lecturers and educators who have a message for Optometry to use the class room and equipment of the institute for audiences up to fifty. These facilities will be available for either day or evening meetings, or for series of meetings. However, the right is reserved to distinguish between programs offered by visitors and those presented by the Post Graduate Eye Institute.

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OKLAHOMA ASSOCIATION ACTIVITIES

According to Dr. E. B. Alexander, Secretary of the Oklahoma Association of Optometrists, and Dr. W. S. Farmer of the educational committee, the annual clinic program held during the month of October as conducted by the association under the auspices of Dr. A. M. Skeffington, was very successful. Clinics were held in five cities in Oklahoma with 87 optometrists in attendance.

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TEXAS OPTOMETRIC SOCIETY

Eight optometric locals throughout the state of Texas are now studying under the direction of the Graduate Foundation. These groups meet monthly to study and review the material as presented from month to month by the foundation under the direction of Dr. A. M. Skeffington, who meets with each group in person once every year. During 1930, Dr. Skeffington spent the first three weeks of October in Texas.

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CAMDEN ZONE MEETING

The first meeting of the Camden Zone of the Graduate Clinic Foundation Extension Course was held in Belfast at the office of Dr. Mervyn Bird on November 10th. The topic studied was, "The Altered Status of the Ophthalmoscope in Optometric Diagnostic Procedure." The chairman presented the Modified Dean Technique of Ophthalmoscopic Procedure. The second meeting will deal with "Interpreting the Ductions in Refractive Procedure."

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IOWA APPOINTS MANAGER

The Iowa Association of Optometrists has created a new office, that of a managing director. Mr. George N. Lyman has been appointed managing director of the Iowa Association with offices at 403 Fleming Building, Des Moines. His duties will consist of looking after matters pertaining to legislative problems, the increasing of the Association membership, the care of complaints, helping in the prosecution of law violators, publicity, and to promote the welfare of the Association.

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CLINIC IN PHOENIX, ARIZONA

On November 13, 14 and 15, 1930, Dr. A. M. Skeffington of the Graduate Clinic Foundation held an enthusiastic group of optometrists for both day and night sessions at the Hotel Westward-Ho. Arizona optometrists have decided unanimously to adopt his routine of examination and have asked for a return engagement to take up special advanced work. This is the Arizona group's second year of the Foundation Clinic Work.

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HARTFORD COUNTY GROUP

The Hartford County Optometric Association held a meeting at the office of Dr. J. Wheeler, 750 Main St., and the November study outline of the Skeffington Clinic Foundation was taken up on the "Value of Phorias in an Ocular Examination." This was a splendid meeting and it was the unanimous vote that these papers of the Graduate Clinic Foundation this year are the finest material for the understanding of phorias, ductions and refractive interpretation Optometry has ever seen.

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NORTHWEST IOWA ASSOCIATION

The annual meeting of the Northwest Iowa Association will be held in Sioux City the week of January 12th. Dr. A. M. Skeffington, chief clinician of the Graduate Foundation Clinic, will speak and also conduct a clinic during the week.

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MAINE ASSOCIATION CONVENTION

The 31st Annual Meeting of the Maine Association of Optometrists will be held at Eastland Hotel, Portland, the 14th and 15th of January. A very interesting and instructive program has been arranged. A unique feature of the convention will be a three-hour session which will be devoted to short talks and discussions of ten minutes each touching many vital subjects in the practice of optometry. Dr. Julius Neumueller of the Pennsylvania State College of Optometry will be the principal speaker.

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